

REMARKS

Claims 1-4, 6-11, 14-21 and 23-24 are the claims presently pending in the application. Claims 1-2 and 6-7 have been amended to more particularly define the invention. Claims 23 and 24 have been added to assure Applicant the degree of protection to which his invention entitles him. Claim 22 has been canceled without prejudice or disclaimer.

It is noted that the claim amendments are made only to assure grammatical and idiomatic English and improved form under United States practice, and are not made to distinguish the invention over the prior art or narrow the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 1-2 were rejected under 35 U.S.C. §103(a) as being unpatentable over Barthelmes et al. (U.S. Patent No. 5,001,395). Claims 3-4, 6-11, 15-16, 19 and 22 were rejected under 35 U.S.C. §103(a) as being unpatentable over Barthelmes et al., in view of Honda et al. (U.S. Patent No. 6,249,086). Claims 14, 17 and 21 were rejected under 35 U.S.C. §103(a) as being unpatentable over Barthelmes et al. in view of Honda et al., and further in view of Takeuti et al. (U.S. Patent No. 6,211,616). Claim 18 was rejected under 35 U.S.C. §103(a) as being unpatentable over Barthelmes et al., in view of Honda, et al. and further in view of Genz (U.S. Patent No. 5,635,796). Claim 20 was rejected under 35 U.S.C. §103(a) as being unpatentable over Barthelmes et al., in view of Sugitani et al. (U.S. Patent No. 6, 271,628). These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

An exemplary aspect of the invention, as recited in claim 1, is directed to a high pressure discharge lamp, including a pair of electrodes disposed in a bulb opposite each other and each electrode of the pair of electrodes being connected to one of a pair of conductive elements which are sealed at a sealing portion of the bulb, wherein a part of each electrode of the pair of electrodes is sealed within the sealing portion to form a contacting portion formed by the part of each electrode of the pair of electrodes in physical contact with a material of the bulb, and

a maximum length L_{\max} , of the contacting portion is defined as:

$$L_{\max} (\text{mm}) \leq 200 / (P \times D); \text{ and}$$

a minimum length, L_{\min} , of the contacting portion is defined as:

$$L_{\min} (\text{mm}) \geq 0.8 / (D^2 \times \pi) \text{ or}$$

$$L_{\min} (\text{mm}) \geq 0.7 \text{ whichever is longer,}$$

where D is the diameter (mm) of the corresponding electrode of the pair of electrodes and P is the power (W) supplied to the corresponding electrode of the pair of electrodes, wherein the contacting portion terminates inside and beyond an edge of one of the pair of conductive elements.

Another aspect of the invention, as recited in claim 6, is directed to a high pressure discharge lamp, including a pair of electrodes disposed in a bulb opposite each other and each of the pair of electrodes being connected to one of a pair of conductive elements which are sealed at a sealing portion of the bulb, wherein a part of each electrode of the pair of

electrodes is sealed within the sealing portion to form a contacting portion formed by the part of each electrode of the pair of electrodes in physical contact with a material of the bulb, wherein R_{\max} of the contacting portion of each of the electrodes is about 5 μm or less, wherein R_{\max} is a maximum of an absolute value of a difference between a distance from an axial center of each of the electrodes to a particular point on a surface of each of the electrodes and a mean value of the distance, and wherein the contacting portion terminates inside and beyond an edge of one of the pair of conductive elements.

Conventional bulbs of high-pressure discharge lamps are sealed during the manufacturing process using a shrink sealing method in which the quartz glass bulb is heated and naturally shrunk in order to airtightly seal the bulb. (See Application at page 3, lines 13-24) However, in the conventional shrink sealing method, the difference between the thermal expansion coefficients of the quartz glass bulb and the material of the electrodes is generally not considered. As a result, in cases where a contacting portion between the electrodes and the quartz glass bulb in the sealing portion is relatively long, cracks may be generated in the sealing portion due to stresses created by the different coefficients of thermal expansion of the two materials. The cracks can ultimately cause failure of the quartz glass bulb under operating pressures. While decreasing the length of the contacting portion can suppress the generation of cracks, there is the danger of an electrode falling due to the decreased length and resultant weakening of the portion supporting the electrode. (Application at page 3, line 25 and page 4, lines 1-16)

Additionally, the electrodes of conventional high pressure discharge lamps tend to sputter vigorously causing blackening of the quartz glass bulb in a relatively short amount of time, thus shortening the useful life of the lamp. The amount of halogen gas contained in the bulb can be increased to enhance the halogen cycle efficiency in order to prevent the blackening caused by the electrode sputtering. However, the halogen gas tends to erode the sealing portion of the electrode which eventually results in a blowout of the quartz glass bulb. (Application at page 4, lines 17-23)

The claimed invention, on the other hand, provides a high pressure discharge lamp in which the length of the contacting portion formed by the part of each electrode in physical contact with a material of the bulb is defined as the length for preventing the generation of cracks due to the difference in the thermal expansion coefficients between the quartz glass bulb and electrode and for preventing falling of the electrodes. The maximum length of the contacting portion is determined based on the amount of power supplied to the high pressure discharge lamp and the diameter of the electrode. The minimum length of the contacting portion is determined based on the diameter of the electrode. By employing an appropriate length of the contact portion, which terminates inside and beyond an edge of the conductive element, based on the predetermined formulae, the problems of generation of cracks in the sealing portion and falling of the electrodes can be avoided.

The invention further provides a high pressure discharge lamp wherein the maximum value of the surface roughness of a contacting portion, formed by the part of each electrode in physical contact with a material of the bulb and terminating inside and beyond an edge of the

conductive element, is kept below a certain level. This feature reduces the stresses created in the sealing portion during the manufacturing process due to the different thermal expansion coefficients. Therefore, cracks resulting from such stresses, and lamp blowouts due to such cracks, are accordingly reduced.

II. THE PRIOR ART REFERENCES

A. The Barthelmes et al. Reference

The Examiner alleges that Barthelmes et al. teaches the invention of claims 1 and 2. Applicant submits, however, that there are elements of the claimed invention, which are neither taught nor suggested by Barthelmes et al.

Barthelmes et al. discloses tightly surrounding the electrode shafts of a high pressure discharge lamp with small tubes of electrically insulating material that is highly temperature resistant in order to protect the tungsten electrode shafts extending into a quartz glass discharge chamber from attack by metal halides included in the fill thus improving the color rendition of the discharge. (Barthelmes et al. at Abstract)

However, Barthelmes et al. does not teach or suggest a part of each electrode of the pair of electrodes being sealed within the sealing portion to generate a contacting portion of specific length and/or surface roughness formed by the part of each electrode of the pair of electrodes in physical contact with a material of the bulb, wherein the contacting portion terminates inside and beyond an edge of one of the pair of conductive elements, as recited in claim 1.

Rather, the contacting portion disclosed by Barthelmes et al. extends from the sealing portion to the edge of the foil, and though the electrode extends into the foil, the contacting portion is defined in column 3, lines 49-51 of Barthelmes et al. as terminating at the edge of the foil. On the other hand, as recited in claim 1, the contacting portion of the present invention is defined as the part of the electrode in physical contact with a material of the bulb and terminating inside and beyond an edge of one of the pair of conductive elements. Thus, in essence, the contacting portion of the claimed invention extends from the sealing portion inside the bulb to the end of the electrode which is inside and beyond the edge of the conductive element. Clearly, such a contacting portion is not taught or suggested by Barthelmes et al.

Indeed, in the Office Action dated 04/23/2003 in the parent case of the present application (Application No. 09/803,655 now issued as Patent No. 6,759,806), the Examiner stated that "no prior art suggests or shows an electrode ... where the contacting portion is defined as extending from the sealing portion to the end of the electrode, where the end of the electrode is inside the foil beyond the edge of the foil." As above, the Examiner in that Office Action indicated that "the contacting portion disclosed by Barthelmes et al. extends from the sealing portion to the edge of the foil, and though the electrode extends into the foil, the contacting portion as defined in column 3, lines 49-51 terminates at the edge of the foil." (See Application No. 09/803,655, paper 11, page 9, lines 3-9) In light of the above, Applicant respectfully submits that claim 1 is likewise allowable.

Therefore, Applicant submits that there are elements of the claimed invention that are not taught or suggest by Barthelmes et al., and the Examiner is respectfully requested to withdraw this rejection.

B. The Honda et al. Reference

The Examiner alleges that Barthelmes et al. would have been combined with Honda et al. to form the invention of claims 3, 4, 6-11, 15, 16, 19, and 22. However, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Honda et al. discloses a high pressure discharge lamp wherein the surface of the electrode has an average value of center line average roughness Ra of 0.3 μm or less, or an average value of the ten-point average roughness Rz of 1 μm or less, or an average value of the surface area increasing rate of 1.0% or less. (Honda et al. at Abstract)

Applicant respectfully submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In fact, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination, as alleged by the Examiner. Indeed, contrary to the Examiner's allegations, neither of these references teaches or suggests their combination.

Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

The Examiner admits that Barthelmes et al. does not teach the feature of a surface roughness at the electrode of 5 μm or less. Rather, the Examiner attempts to rely on column 16, line 65 of Honda et al. to make up for the deficiencies of Barthelmes et al. with regards to claims 3, 6, 9-11 and 19.

However, nowhere does Honda et al. teach or suggest a contacting portion formed by the part of each electrode in physical contact with a material of the bulb, wherein a maximum surface roughness of the contacting portion of each of the electrodes is about 5 μm or less, such that the generation of cracks due to stresses caused by the surface roughness may be prevented. (See Application at page 18, lines 15-23)

Rather, Honda et al. specifically discloses that the electrode 3 is made by winding a tungsten wire around the tip end of the anti-halogenation material portion 2b and the surface of the electrode 3 is polished to the desired surface roughness. (See Honda at Figure 1 and column 16, lines 21-26) Honda et al. further alternatively indicates that the electrode is provided at the tip of the tungsten rod wherein the proximal end of the electrode shaft may be connected to the tip end of the rod, an electrode coil may be mounted on the tip end, or the electrode may be integrally formed therewith. (Honda et al. at column 6, lines 29-35) The surface of the electrode to be polished is measured as a surface of an electrode axial portion adjacent to the main portion of the electrode coil or the like, based on how easily the

roughness of the surface can be measured and the degree of influence regarding the scattering of the substance for the electrode. (Honda et al. at column 5, lines 14-19)

The claimed invention, on the other hand, provides for a maximum surface roughness of the contacting portion of each of the electrodes. The contacting portion is defined and claimed as being formed by the part of the electrode in physical contact with a material of the bulb. Clearly, there is no teaching or suggestion in Honda et al. of this feature of the claimed invention. Honda et al. actually teaches away from polishing such a contacting portion indicating that the portion connected to the sealed metal foil and covered by quartz glass have relatively low temperatures, therefore the amount of electrode substance scattered is small. (Honda et al. at column 11, lines 53-56) As such, the contacting portions would have a low degree of influence regarding the scattering of the substance of the electrode in the determination of the surface of the electrode noted above.

Thus, even assuming arguendo that Honda et al. may disclose an electrode having a certain surface roughness, there is no teaching or suggestion in Honda et al. of polishing a contacting portion formed by the part of the electrode in physical contact with a material of the bulb, such that the generation of cracks due to stresses caused by the surface roughness may be prevented, as in applicant's claimed invention. Indeed, the cited reference does not even recognize the desirability or benefit of providing such a feature. Rather, Honda et al. discloses a capillary coil wrapped around the anti-halogenation portion to help absorb the differences in thermal expansion coefficients between the materials in the sealed portion.

(Honda et al. at column 6, lines 22-28) Honda et al. clearly does not make up for the deficiencies of Barthelmes et al.

Further, Honda et al. fails to make up for the deficiencies of Barthelmes et al. described above directed toward a contacting portion formed by the part of each electrode of the pair of electrodes in physical contact with a material of the bulb, wherein contacting portion terminates inside and beyond an edge of one of the pair of conductive elements, as recited in the claimed invention.

Neither Barthelmes et al., nor Honda et al., nor any combination thereof, teaches or suggests this feature. Therefore, Applicant respectfully submits that Barthelmes et al. and Honda et al. fail to teach or suggest each and every element of the claimed invention as recited in claim claims 3, 6, 9-11 and 19.

In light of the above, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of claims 3, 6, 9-11 and 19. Therefore, the Examiner is respectfully requested to withdraw this rejection.

C. The Takeuti et al. Reference

The Examiner alleges that Barthelmes et al. would have been combined with Honda et al. and Takeuti et al. to form the invention of claims 14, 17 and 21. However, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Takeuti et al. discloses a high pressure discharge lamp for preventing blackening of the discharge tube due to potassium oxide (K_2O) and preventing a decrease of illumination maintenance, wherein the fill includes 0.12 to 0.35 mg/mm³ of mercury, 10^{-7} to 10^{-2} $\mu\text{mol/mm}^3$ of at least one halogen gas selected from the group of Cl, Br, and I, and the tungsten of the electrodes contains no more than 12 ppm of potassium oxide (K_2O). (Takeuti et al. at Abstract)

Applicant respectfully submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In fact, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, contrary to the Examiner's allegations, neither of these references teaches or suggests their combination.

Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

The Examiner admits that Barthelmes et al. and Honda et al. fail to teach the specific amounts of the fill components recited in claim 14, a tungsten electrode comprising potassium oxide as recited in claim 17, and a length of the distance between the opposing electrodes recited in claim 21. Rather, the Examiner attempts to rely on Takeuti et al. to make up for the deficiencies of Barthelmes et al. and Honda et al.

However, Takeuti et al. fails to make up for the deficiencies of Barthelmes et al. described above directed toward a contacting portion formed by the part of each electrode of the pair of electrodes in physical contact with a material of the bulb, wherein the contacting portion terminates inside and beyond an edge of one of the pair of conductive elements, as recited in claimed invention.

Neither Barthelmes et al., nor Honda et al., nor Takeuti et al., nor any combination thereof, teaches or suggests this feature. Therefore, Applicant respectfully submits that Barthelmes et al., Honda et al., and Takeuti et al. all fail to teach or suggest each and every element of the claimed invention as recited in claim claims 14, 17 and 21.

Thus, even assuming arguendo that Takeuti et al. may disclose specific amounts of the fill components, a tungsten electrode comprising potassium oxide, and a length of the distance between the opposing electrodes, as asserted by the Examiner, there is no teaching or suggestion in Takeuti et al. of a contacting portion formed by the part of each electrode of the pair of electrodes in physical contact with a material of the bulb, wherein the contacting portion terminates inside and beyond an edge of one of the pair of conductive elements, as recited in claimed invention. Indeed, the cited reference does not even recognize the desirability or benefit of providing such a feature. Takeuti et al. clearly does not make up for the deficiencies of Barthelmes et al. and Honda et al.

In light of the above, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every

element of claims 14, 17 and 21. Therefore, the Examiner is respectfully requested to withdraw this rejection.

D. The Genz Reference

The Examiner alleges that Barthelmes et al. would have been combined with Honda et al. and Genz to form the invention of claim 18. However, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Genz discloses a high-pressure metal-halide discharge lamp having a mean arc power between 60 and 140 W/mm with a fill comprising mercury, at least one noble gas, at least one halogen, cesium, and tantalum and dysprosium for forming metal halides to produce light with a color temperature between 400 and 700 K at a wall load of between 40 and 85 W/cm² of wall area. (Genz at Abstract)

Applicant respectfully submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In fact, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, contrary to the Examiner's allegations, neither of these references teaches or suggests their combination.

Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

The Examiner admits that Barthelmes et al. and Honda et al. fail to disclose a lamp with a bulb wall load of 0.8 W/mm^2 or more, as recited in claim 18. Rather, the Examiner attempts to rely on Genz to make up for the deficiencies of Barthelmes et al. and Honda et al.

However, Genz fails to make up for the deficiencies of Barthelmes et al. described above directed toward a contacting portion formed by the part of each electrode of the pair of electrodes in physical contact with a material of the bulb, wherein the contacting portion terminates inside and beyond an edge of one of the pair of conductive elements, as recited in claimed invention.

Neither Barthelmes et al., nor Honda et al., nor Genz, nor any combination thereof, teaches or suggests this feature. Therefore, Applicant respectfully submits that Barthelmes et al., Honda et al., and Genz all fail to teach or suggest each and every element of the claimed invention as recited in claim 18.

Thus, even assuming arguendo that Genz discloses a lamp with a bulb wall load of 0.8 W/mm^2 or more, as asserted by the Examiner, there is no teaching or suggestion in Genz a contacting portion formed by the part of each electrode of the pair of electrodes in physical contact with a material of the bulb, wherein the contacting portion terminates inside and beyond an edge of one of the pair of conductive elements, as recited in claimed invention. Indeed, the cited reference does not even recognize the desirability or benefit of providing

such a feature. Genz clearly does not make up for the deficiencies of Barthelmes et al. and Honda et al.

In light of the above, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of claim 18. Therefore, the Examiner is respectfully requested to withdraw this rejection.

E. The Sugitani et al. Reference

The Examiner alleges that Barthelmes et al. would have been combined with Sugitani et al. to form the invention of claim 20. However, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Sugitani et al. discloses a high pressure mercury lamp having a fill including at least 0.16 mg/mm^3 of mercury, a rare gas, and at least one halogen, and in which the wall load is at least 0.8 W/mm^2 . The amount of mercury added being fixed in a range from 2×10^{-4} and $7 \times 10^{-3} \text{ } \mu\text{mol/mm}^3$, and/or the halogen being in the form of a carbonless halogen compound, and/or the average OH radical concentration in an area of the wall of the vessel at a depth of 0.2 mm from the inner surface being at most 20 ppm. (Sugitani et al. at Abstract)

Applicant respectfully submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are completely unrelated, and no person of

ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In fact, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, contrary to the Examiner's allegations, neither of these references teaches or suggests their combination.

Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

The Examiner admits that Barthelmes et al lacks explicit disclosure of the internal pressure of the lamp, as recited in claim 18. Rather, the Examiner attempts to rely on Genz to make up for the deficiencies of Barthelmes et al.

However, Sugitani et al. fails to make up for the deficiencies of Barthelmes et al. described above directed toward a contacting portion formed by the part of each electrode of the pair of electrodes in physical contact with a material of the bulb, wherein the contacting portion terminates inside and beyond an edge of one of the pair of conductive elements, as recited in claimed invention.

Neither Barthelmes et al., nor Sugitani et al., nor any combination thereof, teaches or suggests this feature. Therefore, Applicant respectfully submits that Barthelmes et al. and Sugitani et al. each fail to teach or suggest each and every element of the claimed invention as recited in claim 20.

Thus, even assuming arguendo that Sugitani et al. discloses a lamp with an internal pressure within the range of 8 MPa, as asserted by the Examiner, there is no teaching or suggestion in Sugitani et al. a contacting portion formed by the part of each in physical contact with a material of the bulb, wherein the contacting portion terminates inside and beyond an edge of one of the pair of conductive elements, as recited in claimed invention. Indeed, the cited reference does not even recognize the desirability or benefit of providing such a feature. Sugitani et al. clearly does not make up for the deficiencies of Barthelmes et al.

In light of the above, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of claim 20. Therefore, the Examiner is respectfully requested to withdraw this rejection.

III. CONCLUSION

In view of the foregoing, Applicant submits that claims 1-4, 6-11, 14-21 and 23-24, all the claims presently pending in the application, are patentably distinct over the prior art of record and are allowable, and that the application is in condition for allowance. Such action would be appreciated.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned attorney at the local telephone number

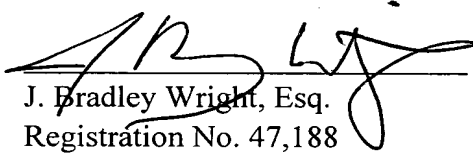
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listed below to discuss any other changes deemed necessary for allowance in a telephonic or personal interview.

To the extent necessary, Applicant petitions for an extension of time under 37 CFR §1.136. The Commissioner is authorized to charge any deficiency in fees, including extension of time fees, or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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